TESTS OF MASTER CAR BUILDERS' COUPLERS.*

The subject of safety appliances in railway cars has recently claimed the attention of the government of this country and laws passed relating thereto will make it of more than usual interest for the next few years. One of the features of legislation has been that of car couplers, and a bill was passed in March of this year, section 2 of which reads as follows.

"That on and after the first day of January, 1898, it shall be unlawful for any such common carrier to haul or permit to be hauled or used on its line any car used in moving interstate traffic not equipped with couplers, coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars."

That a general impetus has by this action been given to the manufacture of couplers is evident from the number of companies that are now forming. The parent companies have in many cases fallen into errors and pitfalls, and it is imperative that every precaution should be taken to prevent a repetition of history by other companies following in their footsteps. The most difficult problem the railroads will have to handle will doubtless be a judicious encouragement of competition, conducted so as to avoid the introduction of devices which by their inferiority are likely to mar and destroy the efficiency of the meritorious ones. That the burden of this responsibility will rest with the mechanical department of the railroads must, of course, be apparent.

In view of the foregoing it was thought advisable to conduct, under the charge of a committee from the Western Railway Club, a public series of tests of M. C. B. couplers.

Some will ask why should these tests be public? Why not allow each railroad or manufacturer to conduct such tests and investigations as it sees fit, the way it does with various other devices which collectively make up the outfit and plant of a railroad, and which are so radically different on many lines, sometimes to their advantage, and sometimes otherwise? The reply to this is that freight car maintenance in this country is unique and different from any other question in connection with the mechanical department of a railroad. Freight cars are all practically in a big pool and every manager is interested not only in his own line having the best and most economical car that it is possible to construct, but also in his neighbor having the same or its equivalent. A proper recognition of this fact is what has given the Master Car Builders' Association its present high standing among associations: That our railroad managers realize the advantages gained by this big freight car pool is fully proven by the support and encouragement they give the association, not only in contributing liberally towards its support, but in affording facilities and means for its members to pursue the investigations which are so essential to the success of such an organization.

For a railroad to fully reap the advantages of any information it may have regarding freight car appliances, it is almost essential that such information should be rounded up by opinions collected from a variety of sources and which through their publicity must necessarily be of a disinterested character.

Public tests as carried on by the M. C. B. Association are largely beneficial from their educational standpoint. Tests and investigations conducted by private interests are seldom as effective and far reaching, whether the private interests be that of a railroad company or of a manufacturing company. The Master Car Builders' Association has had ample evidence of this fact in the various investigations it has undertaken in the last few years and in no single case is it more glaringly instanced than in the matter of air brakes. The original brake tests proposed in the fall of 1885 seem almost childish, at present reading, and yet after two years' work they resulted in practically revolutionizing the status of the brake question.

That good results are already coming from the coupler tests proposed last year is evident from the fact that many of the manufacturers are now equipped not only with apparatus and machinery for making the drop tests, but with appliances and machinery for tensile tests, and some of the most advanced are taking up the chemical questions involved. With these appliances they are enabled to gather information at their own works in a comparatively short time, which heretofore could only be obtained by tedious and slow service test on a railroad. We do not wish to be understood as ignoring the importance and usefulness of service tests. We consider them essential in all cases. It is, however, possible, through a shop test to cull out some of the more glaring defects of a device much more quickly than from a severe test, and herein it is believed rests its great advantage. It is gratifying to know that in several instances the importance of the M. C. B. shop tests is so fully recognized by manufacturers that not only couplers but air brakes are being tested and materially raised in efficiency without any service tests whatever, and regardless of the fact that in several instances they are already vastly superior to many of the appliances that in the past have been purchased and placed in quantities under the car equipment of railroad companies. This condition is brought about by the M. C. B. Association's proposed standards of efficiency for safety appliances and is directly in the line of one of the goals sought after, viz: that of encouraging competition without endangering the efficiency of devices that have a recognized value.

In arranging for the tests made by your committee, invitations were sent to all the coupler companies whose addresses could be obtained, and in nearly every case not only was a ready acquiescence given to participate in the investigation, but assurances of hearty approval and co-operation of the committee's efforts were made on the part of the manufacturers.

The scope of the tests as outlined was as follows:

Pulling Tests.—April 17th and 18th, 7:30 a. m., world's fair, machinery hall. Riehle Bros.' 200,000-lb. testing machine. Under supervision of Robert W. Hunt & Co.

Drop Tests.—April 19. 7;30 a. m. The Sargent Co.'s works, 59th and Wallace streets, Chicago. Under supervision of Robert W. Hunt & Co.

1. Paragraphs 2, 3 and 4 of M. C. B. specification tests as described on page 134 of the M. C. B. annual report of 1892. (Bars not to be tested to destruction in these tests except in the drop test.)

2. Single lug test. The upper lug of one bar will be coupled to the lower lug of the other, and pulled to destruction.

3. New knuckles will then be inserted and the bars pulled to destruction under the pulling test of test No. 1.

All bars will be subjected to tests 1 and 2. Test No. 3 will depend upon the time occupied in tests 1 and 2.

1. The drop tests will be arranged so as to practically cover the guard arm tests recommended.

2. Paragraphs 2 and 3 of the recommended additional tests will be omitted.

Committee on description of bars.—D. L. Barnes, chairman.

Committee to prepare draw-bars for test.—F. M. Whyte, chairman.

Committee on testing apparatus.—J. C. McMynn, chairman.

Committee on test records.—C. H. Quereau, chairman.

Committee on photographic records.—F. W. Sargent, chairman.

Each company entering the tests will be required to give the following information:

The kind of material in the draw-bar.
The kind of material in knuckle.
The kind of material in lock.
The kind of material in knuckle pin.

State whether the bars were specially made for test purposes.

(The committee does not object to having bars made specially for testing.)

State if the bars are supposed to represent the average product of what is manufactured.

If the bars are second hand and have been taken from service, state how long they have been in service.

If parts of the bars are made of steel state whether made by the Bessemer or open hearth process, and give the percentage of carbon in the steel.

It was found necessary to make modifications in the tests, but as a whole they may be classed as satisfactory and exceedingly instructive. Table No. 1 gives a full description of each bar including its weight, number of parts, where made, whether it conforms to the M. C. B. lines,

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*Report of committee of Western Railway Club.

TABLE NO. 1.—SHOWING RESULTS OF DROP TESTS.

Line No.	Commercial Name of Coupler.	1st Blow 10 feet.			2d Blow 10 feet.			3d Blow 10 feet.			4th Blow 15 feet,			5th Blow 15 feet.			6th Blo' 15 feet.	7th Blow 15 feet		8th Blo' 15 feet.	9th Blo' 15 feet.
		Closure of knu'le inches.	Cracks.	Bend ng of shank inches.	Closure knu'le of ches.	Cracks.	Bending of shank inches.	Closure of knu'le inches.	Cracks.	Bending of shank inches.	Closure of knu'le inches.	Cracks.	Bending of shank inches.	Closure of knu'le inches.	Cracks.	Bending of shank inches.	Cracks.	Closure of knu'le inches.	Cracks.	Closure of knu'le inches.	Cracks.
1..	American	⅛			1-16			⅛	1	¼	⅛	1		1-32		½					
2..	"	⅛			⅛		¼	1-16		5-16	1-16		5-16	1-16	1						
3..	Brown				⅛		½	⅜	2	⅝		4	Broke.								
4..	"				⅛		5-16		1	Broke.											
5..	Buckeye	1-16					¼	3-16		⅜				¼	3				1		
6..	"	⅛					¼	¼		½	3-16		¾				1				
7..	California	¼	1		⅜			½	1	⅜		3									
8..	Chicago	3 16			1-16			1-16			1-16	1	⅜	⅛				⅛		¼	2
9	"	1-16			1-32			1-32			1-16		1-16	1-16							
10..	"	⅛			1-16			1-16			⅛			1-16							
11..	"	1-16			1-16			1-16			1-16			⅛							
12..	Drexel	3-32			1-16		¼	1-16		3-16	1-16	2			1		2				
13..	"	3-16			1-16		⅛	⅛	3			1	½								
14..	Hinson	¼			⅛			3-16		¼	3-16	1	⅝			9-16	2				
15..	"	¼			1-16		⅛	⅛		3-16	3-16		⅜		1	Broke.					
16..	Janney	3-16			⅛			⅛		3-16	⅛	1	⅜		1	Broke.					
17..	"	1-16			3-16			1-16		¼	1-16		⅝	1-16	1	¾	1				
18..	Mather	3-16			¼		⅜	¼				1									
19..	Perfected	3-16			1-16			⅛	4	⅛	3-16		3-16		1						
20..	"	¼			¼		⅜	3-16		½	⅛		⅞		1						
21..	Pooley	⅛			⅛	2			1												
22..	"	¼			⅛	2			2												
23..	Sargent	⅛			⅛			⅛	2			1									
24..	Simplex	¼			¼	1		¼		¼		1	Broke.								
25..	"	¼			3-16		⅜	¼	1			1	Broke.								
26..	Standard	¼			¼				1												
27..	"	1-16			⅛		⅛	⅛		½	¼		1 5-16		4	Broke.					
28..	St. Louis	3-16			¼				1	½		1									
29	"	¼	1		3-16		⅛	3-16	1	½	5-16		¾								
30..	Trojan	⅛			1-16		⅜						7-16		2	9-16					
31..	Williams	⅛			⅛			⅛				1									
32..	"	¼			⅛			¼	1		½						3				

LINE NO.	COUPLER COMPANY.	NAMES OF MAKER, BAR AND KNUCKLE.	FRACTURE.	REMARKS.
1..	American Coupler Co.	Solid Steel Co. Alliance		Drop struck knuckle only. Amer. Cont. drawbar slot 1¼ in. x 5 in. After 3d blow slot opened 1-32 in. After 5th blow slot opened 1-16 in.
2..	Brown E. L. C. Coupler Co	Solid Steel Co. Alliance		Amer. Cont. drawbar slot 1¼ in. x 5 in. After 2nd blow slot 1-32 in. wider.
3..	Brown E. L. C. Coupler Co	Shickle, Harrison & Howard, (St.L.)	Crystalline, bright, med., coarse	Drop rested on lug and knuckle. Pivot pin somewhat bent at 3d blow.
4..		Shickle, Harrison & Howard, (St.L.)	Crystalline, bright, med., coarse	Drop rested on lug and knuckle. After 2nd blow would not unlock on account of bent shank.
5..	Buckeye Automatic Car Coup. Co.	(Bar), Col. M. I. & Co. (Knuckle), Solid Steel Co	Fair malleable	Drop struck knuckle only. After 5th blow knuckle unlocked O. K. Amer. Cont. drawbar closed with wedge.
6..	Buckeye Automatic Car Coup. Co.	(Bar), Col. M. I. & Co. (Knuckle), Solid Steel Co	Peculiar malleable	After 2nd blow Amer. Cont. drawbar slot closed ¼ in., after 3d blow ⅝ in., after 4th blow nearly closed. Coupler unlocked after 5th blow.
7..		Solid Steel Co	Fine crystalline	Drop struck on coupler hard and not on knuckle. Would not unlock after 1st blow.
8..	Chicago Ry. Appliance Co	Chicago Tire & Spring Co	Fine crystalline	Drop struck knuckle. Pivot pin bent after 1st blow and coupler would not unlock easily. Would not unlock after 2nd blow.
9..	Chicago Ry. Appliance Co	Chicago Tire & Spring Co.		Drop struck knuckle. After 5th blow coupler would unlock and showed total closing of 5-16 in. when knuckle was pressed in.
10..	Chicago Ry. Appliance Co	Chicago Tire & Spring Co.		Heat 1220.
11..	Chicago Ry. Appliance Co	Chicago Tire & Spring Co		Heat 1211. Second blow lock bar bent. Knuckle loose.
12..	Drexel Ry. Supply Co	Solid Steel Co. Alliance		Drop struck knuckle only. After 5th blow pivot pin bent ¼ in.
13..	Drexel Ry. Supply Co	Solid Steel Co. Alliance	Fine crystalline	After 1st blow pivot pin bent and coupler would not unlock.
14..	Hinson Car Coupler Co	Nat. Mal. Cast. Co.* and So. Mal Iron Co.†	Good malleable	Drop struck knuckle only.
15..	Hinson Car Coupler Co	Nat. Mal Cast. Co.* and So. Mal Iron Co.†	Fair malleable	After 3d blow knuckle would not open.
16..	McConway & Torley	McConway & Torley	Good malleable	After 2d blow knuckle would not open. Pivot pin bent.
17..	McConway & Torley	McConway & Torley	Good malleable	Drop struck lugs of bar only in 1st blow.
18..	A. C. Mather		Fair malleable	Drop struck both lugs and knuckle. After 2d blow knuckle would not unlock. After 3d blow Amer. Cont. slot opened from 1¼ in. to 2⅓ in.
19..	J. A. Hinson	Solid Steel Co. Alliance	Fine crystalline	Drop struck knuckle only. After 3d blow knuckle would not open. This was a defective and condemned coupler.
20..	J. A. Hinson	Solid Steel Co. Alliance	Fine crystalline	Drop struck knuckle only. After 2d blow knuckle would not open. After 5th blow knuckle opened O. K.
21..	Pratt & Letchworth	Pratt & Letchworth	Poor malleable	Drop strikes on draw-bar and knuckle.
22..	Pratt & Letchworth	Pratt & Letchworth		Drop strikes on draw-bar and knuckle.
23..		Sargent Co		Pivot pin bent after 2nd blow. Knuckle would not open. This was a defective coupler and broke through defect.
24..	Simplex Coupler Co	Shickle, Harris & Howard, (St. Louis.)	Med. crystalline porous flaws	Drop struck lugs and knuckle.
25..	Simplex Coupler Co	Shickle, Harris. & Howard, (St. Louis.)	Med. crystalline, porous flaws	Drop struck lugs and knuckle. After 4th blow knuckle opened hard.
26..	Standard Car Coupler Co		Poor malleable	
27..	Standard Car Coupler Co		Fair malleable	
28..	St. Louis Coupler Co	Shickle, Harris. & Howard, (St. Louis.)	Med. crystalline, few blow holes	Drop struck knuckle only. Two knuckles were broken in this bar.
29..	St. Louis Coupler Co	Shickle, Harris & Howard, (St. Louis.)	Med. crystalline, few blow holes	Drop struck knuckle only. After 2d blow knuckle would not unlock.
30..	Trojan Car Coupler Co		Good malleable	Drop struck knuckle only.
31..	Dyer Williams			Knuckle would not unlock after 2nd blow.
32..	Dyer Williams			Knuckle would not unlock after 2d blow.

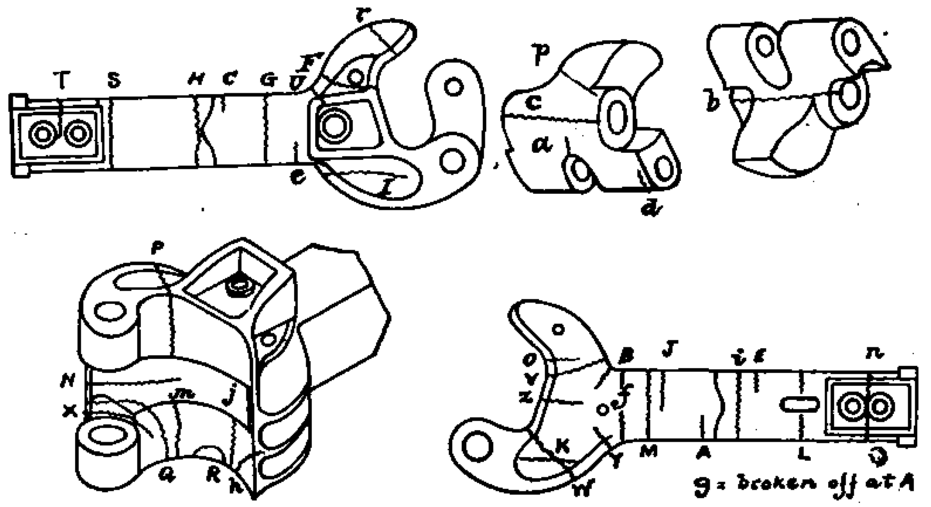
*Chicago. †Chattanooga.

etc. It also gives the chemical analysis of most of the bars submitted to test. These results are from borings taken after the bars had been broken under the drop and as near the point of fracture as was practicable.

Table No. 2 is an individual account of the performance of each bar under the drop. The drop tests were actually from a height of 10 ft. 4 in. and 15 ft. 4 in., the foundation, which was of masonry constructed as shown in Fig. 17 (see next page), sinking during the tests about 4 in. The drop tests as conducted were criticised by some of those present, and apparently with reason, as not in all cases representing the same blow owing to the bar flying away from its position after being struck. This may be a legitimate criticism; if there is any point in it the fault will be checked up by the M. C. B. tests which have since then taken place at Altoona, the M. C. B. committee having arranged to wedge in their bars so that they could not fly off while under test. The committee's object in not securing the bar was in order to introduce a guard arm test; this, however, did not turn out as was expected, and in future investigations this feature should be

TESTS OF M. C. P COUPLERS.—TABLE NO. 2.

Name of Coupler.	Material in Coupler.	Material in Knuckle.	Weight.	Weight of Knuckle.	No. of Parts.	Silicon.	[illegible]	Manganese.	Carbon by Color.	Graphitic Carbon.	Combined Carbon.
American...	C S	C S	210¼ 216	50 50	5 5	·060	·075	·86	·28	....	....
Brown......	C S	C S	220 219	39 39	7 7	·027	·116	·74	·14	....	....
Buckeye....	M I	C S	228 220	57 57	9 9	....	....	....	....	....	....
California	C S	C S	220½	....	4	·214	·111	1·03	·30	...	....
Chicago.....	C S	C S	218 218½	54 54	4 4	....	....	....	....	....	....
Chicago....	C S	C S	220 22)	54 54	7 7	....	....	....	....	....	....
Drexel......	C S	C S	217½ 216	60 60	5 5	·194	·103	1·06	·30	....	....
Hinson	M I	C S	222 217½	51 51	5 5	·652	·161	2·8 ...	....	2·19	·58 ....
Mather	M I	C S	204½	36	5	....	....	....	....	....	....
McConway ..	M I	W I	220	37½	4	...	....	....	....	...	....
Perfected...	C S	C S	201½ 200	....	...	·327 ·195	·097 ·088	1·29 1·32	·30 ·25	....	....
Pooley......	M I	C S	204 208	....	4	....	....	....	....	....	....
Simplex . ..	C S	C S	200 191	42 42	6 6	·026 ·068	·061 .062	·63 ·50	·31 ·29	....	... .
Standard....	M I	F S	206½ 206½	67½ 67½	3 3	....	....	... .	... .	....	....
St. Louis....	C S	C S	214½ 217	....	5 5	·058	·074	·87	·28	....	....
Trojan........	M I	C S	213½	50	....	·554	·169	·32	...	2·93	.24
Williams....	M I	C S	202 2 15	....	7 7	.... ..	....	....	....	....	....
Sargent.......	....	....	220	....	....	....	....	....	....	....	....



KEY TO TABLE 1.

TABLE NO. 3—PULLING TEST.

Name of draw-bar.	Material.		100,000 Pounds Pull, Breaking Strain Pounds.			120,000 Pounds Pull, Breaking Strain Pounds,		
	Bar.	Kn'c'le	Bar.	Kn'c'le	Remarks.	Bar.	Kn'c'le	Remarks.
Americ'n	Steel	Steel	O K	O K	Knuckles opened 5-16 in.	119700	O K	Sheared pivot pin on one, and cracked lower lug on other bar.
Buckeye.	Mal. I	Steel	O K	O K	Knuckles opened 1-16 in. and ⅛ in.	O K	O K	Knuckle opened ⅛ in. and 3-16 in. Pivot pins O. K. Unlocked O. K.
Brown....	Steel	Steel	O K	O K	Knuckles opened 5-16 in.	O K	106400	Knuckle broke through pivot pin hole. Fracture medium crystalline, showing a number of blow holes.
Calif'rn'a	Steel	Steel	O K	O K	Knuckles opened ¼ in. and ⅜ in.	O K	O K	Knuckle opened ¼ in. and ⅜ in. Pivot pins somewhat bent.
Chicago..	Steel	Steel	O K	O K	Knuckles opened 3-16 in.	O K	O K	Knuckles opened ¼ in. Unlocked O. K.
Drexel....	Steel	Steel	O K	O K	Knuckles opened ⅛ in.	O K	O K	Knuckles opened 7-16 in. Unlocked O. K.
Hinson...	Mal. I	Steel	O K	O K	Knuckles opened ¼ in.	O K	O K	Knuckles opened ⅜ in.
Janney ..	Mal. I	Wt. I	O K	94,600	Knuckle opened 13-16 in. Broke 2 in. off tail of knuckle.			
Perfected	Steel	Steel	O K	O K	Knuckle opened 3-16 in. and 7-16 in.	105900	O K	Fracture fine crystalline, about half blow holes.
Pooley ...	Mal. I	Steel	91,400	O K	Broke off both lugs and half of back from bar.			
Simplex..	Steel	Steel	O K	O K	Knuckles opened ⅜ in. and ¼ in.	O K	112000	Broke through pin hole of knuckle. Fracture coarse crystalline 1 sq. in. flaw. 1 pivot pin badly bent.
St. Louis.	Mal. I	Steel	O K	O K	Knuckles opened 1-16 and ⅛ in.	O K	O K	Knuckle opened ⅛ in. Unlocked O. K. Pivot pins not bent
Williams	Steel	Steel	96,600	O K	Knuckles opened ¼ in. Unlocked O. K. Broke through both bar lugs. Fracture medium cryst about ½ blow holes.			

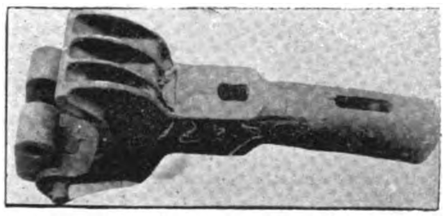


FIG. 1.—AMERICAN COUPLER—Steel; 3 blows at 10 feet, 2 blows at 15 feet.

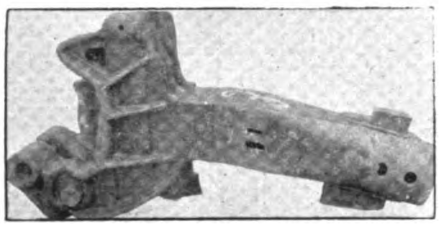


FIG. 2.—BUCKEYE COUPLER—Malleable Iron Bar, Steel Knuckle; 3 blows at 10 ft., 2 blows at 15 ft.

FIG. 3.—BROWN COUPLER—Steel; 3 blows at 10 feet, 1 blow at 15 feet.

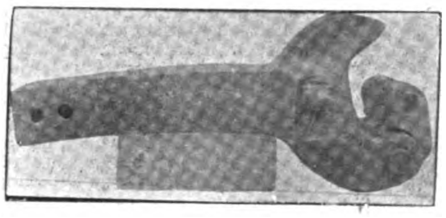


FIG. 4.—CHICAGO COUPLER—Steel; 3 blows at 10 feet, 2 blows at 15 feet.

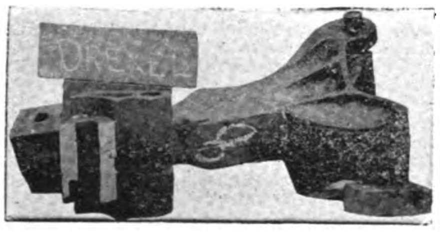


FIG. 5.—DREXEL COUPLER—Steel; 3 blows at 10 feet, 2 blows at 15 feet.

FIG. 6.—HINSON COUPLER—Malleable Iron Bar; 3 blows at 10 feet, 2 blows at 15 feet.

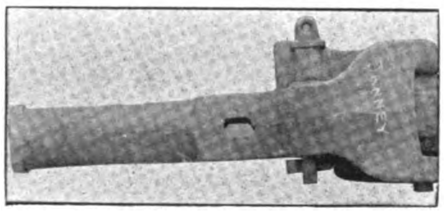


FIG. 7.—JANNEY COUPLER—Mal. Iron Bar, Wro't Iron Kn'ckle; 3 blows at 10 ft., 2 blows at 15 ft.

FIG. 8.—MATHER COUPLER—Malleable Iron Bar, Steel Knuckle.

FIG. 9.—NATIONAL; formerly PERFECTED—Steel; 3 blows at 10 feet, 2 blows at 15 ft.

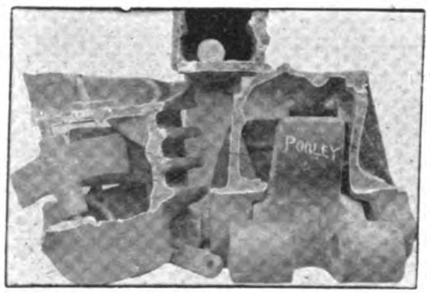


FIG. 10.—POOLEY COUPLER—Mal. Iron Coupler, Steel Knuckle; 3 blows at 10 feet.

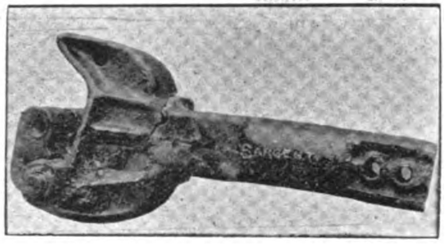


FIG. 11.—SARGENT COUPLER—Steel; 3 blows at 10 feet, 1 blow at 15 feet.

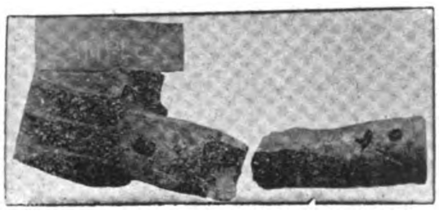


FIG. 12.—SIMPLEX COUPLER—Steel; 3 blows at 10 feet, 1 blow at 15 feet.

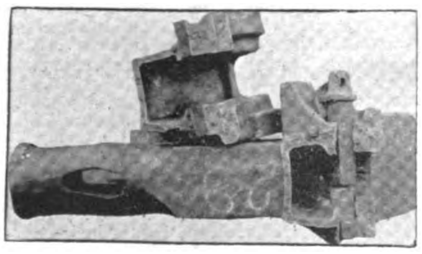


FIG. 13.—STANDARD COUPLER—Mal. Iron Bar, Steel Coupler; 3 blows at 10 feet.

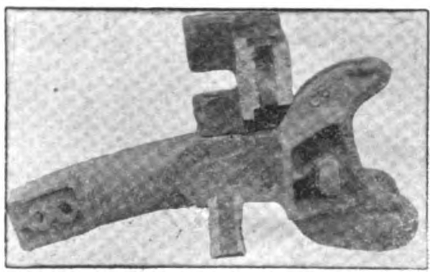


FIG. 14.—ST. LOUIS COUPLER—Steel; 3 blows at 10 feet, 2 blows at 15 feet.

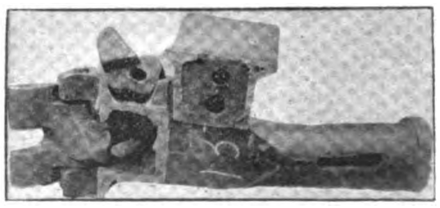


FIG. 15.—TROJAN COUPLER—Mal. Iron Bar, Steel Knuckle; 3 blows at 10 ft., 2 blows at 15 ft.

FIG. 16.—WILLIAMS COUPLER—Mal. I. Coupler, Steel Kn'ckle; 3 blows 10 ft., 2 blows at 15 ft

worked out more carefully and properly provided for.

Figs. 1 to 16, inclusive, are reproduced from photographs showing the appearance of the draw-bars after the drop tests.

The pulling tests are shown on table No. 3.

It will be observed that in the 100,000 lb. pull all but two of the 13 bars met the test. Of those failing the Janney gave way at the tail end of the knuckle, and the Williams at the lugs of the draw-bar.

The 120,000 lb. pull was met by six of the remaining 11 bars. An attempt was then made to pull the six intact bars to destruction. The Drexel reached 132,800 lbs. when part of the testing apparatus failed, namely, the head pulled off the iron tail bolt which was 2 in. in diameter. The other bolts not fitting, the test with this particular bar was abandoned, and one of the Chicago bars substituted. At 142,000 lbs. it was observed that another part of the testing apparatus was giving way; the yoke fastening commenced to spread and the yoke bolt bent. It was, therefore, decided to abandon all further attempts at pulling bars to destruction.

It has been previously stated that the tests were exceedingly instructive. Let us briefly consider some of the special features developed.

1. It was proved beyond all peradventure that in so far as the present M. C. B. tests are concerned draw-bars can be made of either malleable iron or steel not only to meet the tests but to go much beyond them.

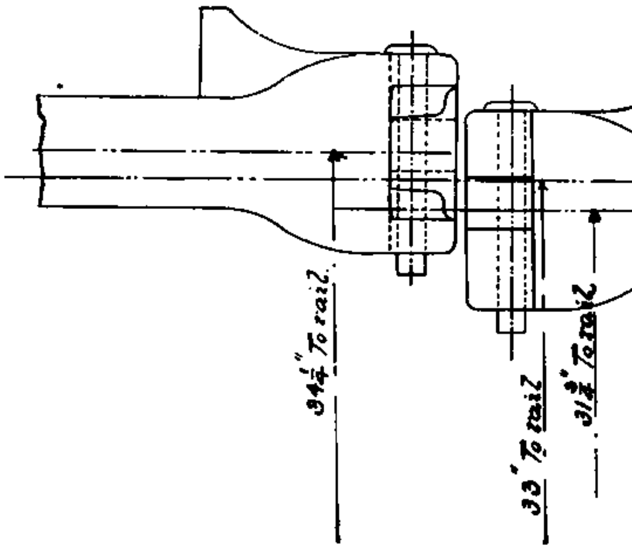
2. The committee was made to realize fully that its investigations were not nearly as thorough and searching as they can be made, and that these tests must only be regarded as the commencement of shop investigations.

3. Great carelessness on the part of the manufacturers in the matter of conforming to the M. C. B. contour lines was shown to exist.

It is a matter of regret that the proposed guard arm test was not fully realized. It is estimated that 50 per cent. of M. C. B. draw-bar breakages are in the guard arm and perhaps 25 per cent. of the remainder are back of the head or in the shank. An examination of the photographs will show clearly the weakening effect on the shank by core holes, slots for continuous attachments, and barrel openings for that worst of all fasteners, the tail bolt. Draw-bars can be materially strengthened and simplified if constructed for a yoke or strap fastening only and we strongly advise both railroad companies and coupler manufacturers to take this into consideration at once.

It will be observed that in each series of tests two distinct parts were tested at the same time, viz: the draw-bar and knuckle. The combination test under the drop has generally worked out satisfactorily but it is not the case in the pulling test. It would certainly seem desirable to test the pulling strength of the draw-bar, especially the lugs of the bar, without knuckle in position. This test it is understood has been provided for at the Watertown M. C. B. tests.

The single knuckle lug test is another important matter that the committee could not carry out, but it should be considered in future work, as it is believed that many of the knuckle lug failures in service are due to the buffing or pulling of bars when only single lugs are in contact. A question which many would like solved is what variations in height from center of draw-bar to top of rail can we safely allow in the interchange of freight cars. The answer to this in so far as it applies to cars fitted with the vertical plane coupler largely depends on whether it is necessary to have two lugs always in contact or only single lugs. Let us first consider what the limits would be with two lugs always in contact. The standard height for freight car draw-bars when empty is 33 inches. The vertical face of the knuckle of the M. C. B. bar is 9 in. with a 2⅛ in. opening between lugs. With some knuckles the upper lug is 3¾ in. long and lower one 3 in. See Fig. 18. With a 9 in. vertical face the grip of any two bars may consequently extend 4⅛ in. above the standard or 4⅛ in. below the standard and still have 4½ in. grip with the standard. It would, however, in either case, be a very weak grip, as but one lug of the knuckle would be engaged and the pulling and buffing strength of the bar would be entirely different to any results heretofore shown in shop tests. Let us next consider the greatest possible variation that can be allowed and at the same time insure the gripping together of the two lugs of each bar. The last grip, to be effectual on the second lug, we will assume to be ⅛ in. Fig. 19 shows drawn to scale the relative position of two draw-bars fully engaged on one lug but with only ⅛ inch engagement on the other. This allows a variation of not more than 2¾ in. between the center lines of any two M. C. B. couplers, viz.: 34½ in. maximum and 31¾ in. minimum. This, it is hardly necessary to say, would involve a degree of perfection that does not exist at the present time. Clearly then, in service, bars are constantly buffed and



COUPLER TESTS.—Fig. 19.

pulled together, with only one lug in contact and it would seem equally, if not more important, to adopt standards of efficiency for parts of the draw-bar that develop the greatest weakness in service rather than for the bar as a whole. Variations in the height of draw-bars has always been a difficult problem to solve. With a link and pin bar the pin flies out as the slack runs up and the train uncouples. With the vertical plane bar, owing to the variation in the height of bars, going over low joints, one vertical surface will jump over the other, resulting in a train broken in two without the knuckles unlocking. The American Railway Association has now under consideration this problem and will, without doubt, give it the fullest attention. A further advantage to be gained in bringing up the parts of the bar to a higher state of efficiency is that it will require much less expenditure in testing apparatus.

One actual case of freight cars fitted with vertical plane couplers which came apart without the knuckles unlocking and which consquently had to be coupled up with a link

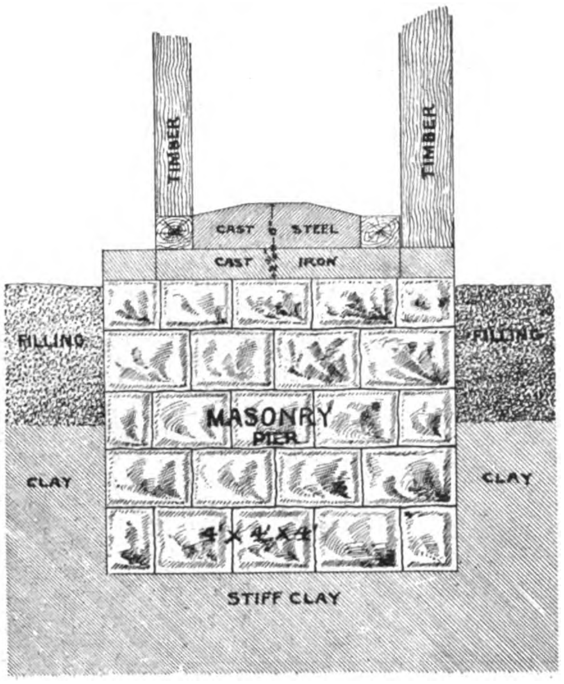
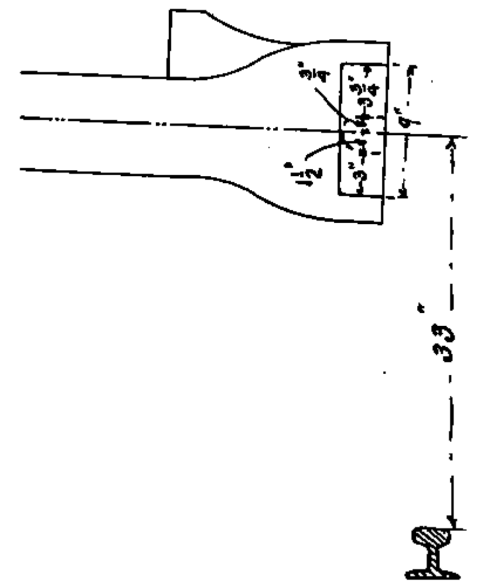


Fig. 17.—FOUNDATION FOR DROP TESTS.

and pin, which has come to the observation of your committee, showed the bar in one car to measure 30 in. from the top of the rail and in the other 35 in., proving beyond question that a 5 in. variation is not safe.

The complete disregard of any attempt on the part of the majority of the manufacturers to conform to the M. C. B. contour lines as called for by the association's maximum and minimum gage should call for some vigorous action on the part of the members of the association. That vertical bars should be sent for test that will not couple with each other seems an astonishing fact, but is none the less a true statement and may be expected to continue just so long as railroad companies are indifferent and careless about the matter. Each railroad company should have at its store a set of the Pratt & Whitney standard gages and check up with them all vertical plane draw-bars purchased. Bars which are sent on the road that will not couple together are a source of danger and undo the very object automatic bars strive to remedy. There is no safety accomplished in having to couple together two vertical plane couplers with a link and pin.



COUPLER TESTS.—Fig. 18.

In concluding, your committee wish to express the many obligations they are under to Robert W. Hunt & Co. for conducting the drop and tensile tests and furnishing all labor and assistance in connection with the use of their pulling machines, to the Sargent Co. for the use of their drop machine, labor and other facilities in carrying out your committee's work, and to H. L. Hollis & Co., chemists, Rookery building, for their very valuable chemical report.

G. W. Rhodes,
C. H. Quereau,
J. C. McMynn,
F. W. Sargent,
D. L. Barnes,
C. F. Street,
Committee.

SOME "FAIR" QUESTIONS.

The following catechism proposed by the general passenger agent of the Chicago, Milwaukee & St. Paul Railway is commended to those newspaper publishers, merchants and hotel keepers who are clamoring for reduced railway rates, while at the same time adding to their own rates.

Will the newspapers that are editorially clamoring for reduced railway fares "to enable people from the country to visit the world's fair," please answer the following questions?

1. Did not the Chicago newspapers for the first two weeks in May constantly proclaim to the whole world that the department buildings were unfinished and leaky, and that exhibits were being despoiled by reason thereof; that very few exhibits were unpacked and in place; that many exhibits had not arrived; that some exhibits had not even left European countries; that the grounds were in horrible condition, but that nothwithstanding all these unfortunate conditions the Columbian Exposition was further advanced toward completion than any other previous exposition within such a short time of the day of opening?

2. Did not the Chicago newspapers publish highly colored—and in some cases untruthful—sensational articles to the effect that extortion of all kinds was practiced by concessionares and restaurant keepers inside the grounds, and by world's fair hotel proprietors outside of the grounds? If there was any truth in those statements when they were published in the early part of May, is there any appreciable difference in the charges for lodgings, food and drink at the present time?

3. Have not the Chicago newspapers unfavorably criticised all of the methods of the exposition officials who labored so assiduously to open the fair on May first? Have they not abused without limit and without legitimate cause a class of valued employes known as "Columbian Guards?" Has there been any other class of exposition employes which has escaped vituperation from the reporters and editors of the Chicago newspapers?

4. Have not the Chicago newspapers denounced the weather as cold, wet, windy and disagreeable during the first three weeks of May, and made the weather responsible to a considerable extent for the small attendance?

5. Have not the Chicago newspapers said that with all these drawbacks it could not be expected that people would visit the fair during the month of May?

6. Have the citizens of Chicago—who can go at a trifling expense for transportation—visited the fair in any considerable numbers during the month of May?

7. Have not the citizens of Chicago read what their own newspapers have said, and have they not staid away from the fair in consequence thereof?

8. Who are the writers who fill Chicago papers with scurrilous reports of incompleteness, extortion, and inefficiency? Are they not sensationalists? What enables them to "mould public opinion" except the fact that what they write is printed, and reiterated in print each day, until the credulous public is forced to believe? Can any "outsider" deny a newspaper statement except at an outlay of a dollar a line, cash in advance, and even then can he get the denial published in the newspaper that made the original statement or mis-statement?

9. Have not the newspapers of other cities with interests inimical to the best interests of Chicago and the world's fair, republished as truth and gospel the unfavorable and unkind (not to say untrue) utterances of the sensational Chicago dailies? Have not the country newspapers advised their readers to stay away from the unfinished fair, and from the city where robbery in all its forms is officially recognized and permitted to go unchecked?

10. Is it not true that during May and the first part of June the entire agricultural and farming portion of the community is necessarily engaged at home in planting and other spring work, and that no rates of fare, however low, and no conditions with respect to the exposition itself, favorable or otherwise, would have a tendency to bring them into Chicago during that period, and is not this fact largely responsible for the non-attendance of country visitors during the first forty days of the fair?

11. Who, then, is to blame for having thus far kept visitors away from the world's fair?

If the newspapers double their customary rates for advertising space, the restaurants add 25 per cent. to the price of food and drink, the places of amusement maintain usual prices, the merchants add a little to the cost of their goods to cover the expense of entertaining their country customers who come to visit the fair, is not a 20 or 30 per cent. reduction in railway fares entitled to consideration as a fair contribution for the railway companies to make for the financial success of the exposition? Does any reasonable person wish to prevent the railways from sharing in the hoped-for benefits to accrue from an enormous attendance of country visitors to the world's fair?

Is it to be supposed that the railway officials propose to prevent their companies from making all the money possible that a reasonable reduction in fares will bring? Does any one—except the newspaper man who "knows everybody's business"—know any better than the well informed railway official, just exactly when and how the country merchant, mechanic and farmer can and will come to the fair?

12. Is it not a fact that each of the great railroads entering Chicago subscribed originally fifty thousand dollars in cash towards creating the exposition, and later subscribed one hundred thousand more? Is it not a fact that each of the Chicago terminal lines has spent from fifty to three hundred thousand dollars for new equipment for the express purpose of being enabled to handle world's fair business, which equipment would not otherwise be required at this time? Is it not a fact that the Chicago terminal lines and other lines within from three hundred to five hundred miles of Chicago have very largely added to their regular train service at a large daily increase in their expenses, in order to enable them to carry world's fair business? Is it not a fact that during the two months preceding the fair regular traffic to Chicago particularly, and elsewhere, has shown a large decrease, owing to the fact that people generally deferred traveling owing to their anticipated visits to Chicago, thereby largely reducing the revenue that the railway companies would otherwise have received from regular business? Is it not a fact that during several months following the close of the fair the same conditions will obtain, and that a still greater loss to the railways will occur as compared with normal business? Is it not a fact that for the above reasons the railways are themselves more vitally interested, in view of their large cash outlay and loss from a decrase in regular business, in making such rates as will have a tendency to bring people to Chicago during the fair, and that the success and prosperity of the exposition means to a greater degree their own success and prosperity than is true of any other interests involved?

And may it not be fairly assumed, in view of these facts, that, with their long experience in handling the details of their own business, and in their intimate relations with the public, railway officials are as competent to judge of the rates that are reasonable and will induce travel as are outsiders?

If the foregoing questions are or are not satisfactorily answered, I will say for the benefit of the exposition

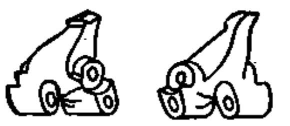
BREAKAGES OF THE JANNEY COUPLER.

In connection with the subject of Master Car Builders' draw-bars, the most valuable information which can be obtained is necessarily in connection with the bars in service. Some of the manufacturers of the different types of couplers are keeping very accurate records of these breakages with a view of discovering the weaknesses of their bars, in order that they may strengthen them. Among the companies that has kept these records are the McConway & Torley Co., whose record is probably the most complete of any in existence. Owing to the large number of these bars which are in use, the records are very valuable, not only in giving the manufacturers information regarding the weak points of their bars, but also in giving the car builders information regarding the utility of the M. C. B type of coupler. The McConway & Torley Co. realize his fact, and have therefore handed us copies of the records which are reproduced herewith. These records, together with the cuts accompanying them, are so clear and comprehensive as to require no explanation, but they are worthy of careful study.

Relative frequency of breakages in different parts of Wrought Iron Janney Freight Coupler Knuckles. Determined by percentage computations from the total number of breakages reported by each Railroad from April 1, 1892, to March 31, 1893.

Nature of Defect	General Aver.	A. V.	B. & O.	C. B. & Q.	C. C. C. & St. L.	Canda C. C. Co.	C. M. & St. P.	C. & N. W.	C. R. I. & P.	C. & O.	G. R. & I.	L. S. & M. S.	L. V.	M. C.	N. C.	N. Y. C. & H. R.	N. Y. C. & St. L.	N. Y. L. E. & W.	N. P.	Penna.	P. Co. N. W.	P. W. & B.	R. & D.	R. W. & O.	U. P.	W. S.	W. N. Y. & P.	W. C.	Miscel-laneous.
Upper Lug Off	25.56	17.85	6.89	23.50	16.02	10.11	32.23	27.73	26.48	15.36	32.93	9.19	22.94	9.96	21.24	15.76	14.33	20.83	21.74	36 11	26.76	29.18	24.77	......	18.18	15.00	8 38	27.78	26.00
Upper Lug Cracked	26.05	31.58	13.79	8.22	41.00	15.73	12.70	16 82	13.82	19.44	16.77	62 05	45.41	41.58	24.94	42.68	52.33	32.61	7.11	22.35	30 50	20.20	17.85	......	7.79	30.00	52 98	7.93	22.26
Upper Lug Chipped	16 90	27.46	9.19	9.11	23 58	52.81	22.84	26 82	27 50	12.85	25.75	12.82	12 84	21.65	31.02	18 27	18.64	22.54	23.95	11.09	14.92	30.17	34.79	......	23.38	16 25	21 35	16 67	12.78
Lower Lug Off	5.18	2 74	0.58	7.85	2 49	5.62	13.80	9.54	6.63	5.33	4.79	2.48	1.83	3.44	3.41	5.54	1.79	4.33	6.84	3.52	5 69	4.74	3 28	......	11.69	10.00	2.97	6.35	5.86
Lower Lug Cracked	2.28	1.83	0.58	1.43	2.39	5.62	2.14	1 36	1.62	1.25	2.99	5.16	5 05	3.09	2.31	3.55	2.15	3.25	1.05	1.62	2 67	2.24	1.28	......	1.30	10.00	2 97	1.59	1.96
Lower Lug Chipped	1.66	1.14	1.14	1.06	2.39	4.50	1.45	2.73	2.63	0.63	......	1.69	2.75	4 47	3.28	1.90	2.51	3.36	1.84	0.75	1.57	3.49	2.55	......	2.60	5 00	3.25	1.59	[illegible]
Both Lugs Off	7.91	5.72	1.14	6.78	4.38	......	4 63	6.82	8.05	3.76	13.77	2.43	5.05	4.81	4 01	4.16	5.02	5 52	21.05	13.41	7.40	3.24	5.46	......	14.28	7.50	2.70	19.05	7.62
Both Lugs Cracked	0.12	0.23	......	0.12	0.10	......	0.21	......	0.10	......	......	0.10	0.46	1.03	......		......	0.17	0.53	0.06	0.08	0 50	0.36	......	......	......	0.27	......	0.15
Both Lugs Chipped	1.50	1.60	0.58	0.98	1.89	3.37	2.55	3.18	4.30	0.94	......	0.65	0.92	1.72	1.46	1.13	1.07	1.65	4.21	0.73	1.18	1.50	4.19	......	3.90	......	2.16	1.59	[illegible]
Upper Lug Off, Lower Cracked	0.92	0.46	0.58	0.70	1.09	......	0.55	0.45	0.83	0.63	0.60	0 25	......	......	0.61	0.52	0.36	0.57	2.10	1.73	0.95	0.50	0.55	......	5.19	2 50	......	2.38	0.10
Lower Lug Off, Upper Cracked	0.20	0 23	......	0.49	0.50	......	0.28	......	0.25	......	......	0.10	......	......	0.24	0.17	......	0.17	......	0.15	0.15	......	......	......	......	......	......	......	0.24
Upper Lug Off, Lower Chipped	1.50	1.83	0.58	1.51	1.19	1.12	2.55	0.81	2.63	0.94	1.80	0.40	1.83	0.69	0.73	0.87	0.72	1.99	0.53	1.63	1.60	0.75	1.09	......	2.60	......	0.81	3.17	1 45
Lower Lug Off, Upper Chipped	1.47	0.69	......	2.00	0.90	......	4.00	2.73	2.89	......	0.60	0.65	0.46	1.03	0.73	1.04	0.36	1.42	5.26	0.79	1.11	0 25	1 64	......	7.79	......	0.81	5.55	1.78
Tail Off	0.69	0.69	......	0 61	0.10	......	......	0.91	0.91	0 63	......	0.45	0.46	2.06	0 61	0.69	......	0 74	0.79	0.92	0.95	0.25	1.46	......	1.30	......	0.54	6.35	0.46
Worn Out	6.25	0.23	64.37	35.60	0.99	1.12	......	......	0.10	36.36	......	0 79	......	4 47	1 22	1.21	0.72	0.17	......	0.90	1.07	2.74	0.73	......	......	......	0.27	......	14.81
No Def'ts Observed	1.74	5.72	0.58	0.04	0.99	......	0.07	......	1.27	1.88	......	0.79	......	......	2.19	1.38	......	0.68	......	4.22	3.21	0.25	......	......	......	3.75	0.27	......	0.39
Miscellaneous	0.07	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.13	......	......	......	0.02	0.19	......	......	......	......	......	0.27	......	0.07
Total	100.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00


UPPER LUG OFF.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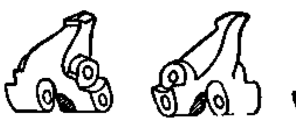
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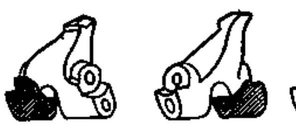
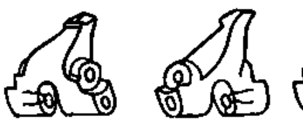

LOWER LUG OFF.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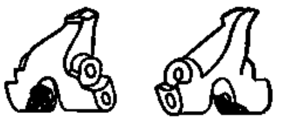
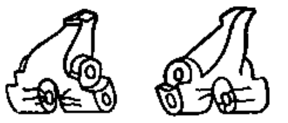
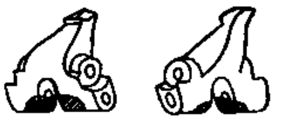
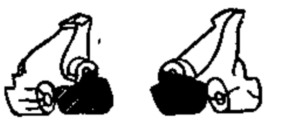
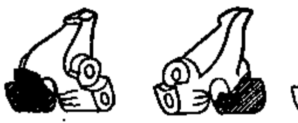

LOWER LUG CHIPPED.


BOTH LUGS OFF.

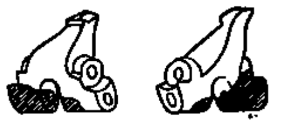

BOTH LUGS CRACKED.


BOTH LUGS CHIPPED.


UPPER LUG OFF, LOWER CRACKED.


LOWER LUG OFF, UPPER CRACKED.


UPPER LUG OFF, LOWER CHIPPED.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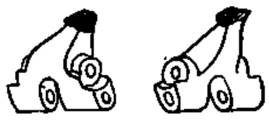
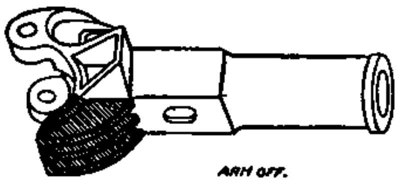
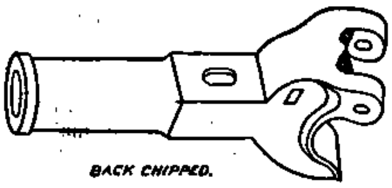
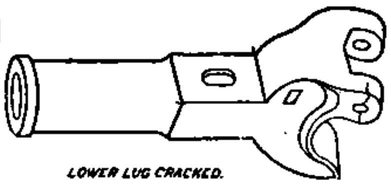

TAIL OFF.

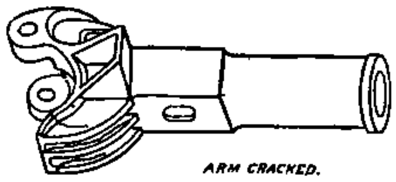
Relative frequency of Breakages in different parts of Janney Freight Coupler Bodies. Determined by percentage computations from total number of breakages reported by each Railroad from April 1, 1892, to March 31, 1893.

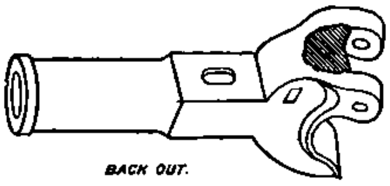
Nature of Defect.	General Aver.	A. V.	B. & O.	C. B. & Q.	C. C. C. & St. L.	Canda C. C. Co.	C. M. & St. P.	C. & NW.	C. R. I. & P.	C. & O.	G. R. & I.	L. S. & M. S.	L. V.	M. C.	N. C.	N. Y. C. & H. R.	N. Y. C. & St. L.	N. Y. L. E. & W.	N. P.	Penna.	P. Co. N. W.	P. Co. S. W.	P. W. & B.	R. & D.	U. P.	W. S.	W. N. Y. & P.	W. C.	Miscel-laneous.
Arm Off	53.69	31.88	51.76	63.89	33.33	39.29	61.99	61.77	50.24	37.59	60.05	33.21	47.27	35.56	48.69	43.87	30.40	31.67	65.12	67.74	50.86	58.90	73.73	41.27	71.18	56.76	25.77	34.62	45.81
Arm Cracked	18.36	13.76	8.23	5.89	33.33	10.71	10.72	8.82	10.62	16.31	11.47	34.64	1 82	28.69	23.09	15.71	30.40	9.71	1.66	5.72	21 63	11.98	3.95	25.40	1.70	......	24.74	3.85	17.92
Arm Chipped	12.59	21.74	21.18	12.07	17.19	46.43	22.24	19.75	22.81	14.18	9.84	17.32	16.18	17.04	9.62	18.20	22.97	12.59	18.95	6.13	9.61	10.03	4.24	11.61	8.47	18.92	27.84	19.23	12.22
Face Cracked	1.46	0.73	1.18	0.28	2.08	......	0.43	0 42	0.94	0.71	1.64	2.93	1.82	2.22	1.66	1.92	2.70	1.17	0.38	0.84	2.65	0.82	2.26	0.79	1.70	2.70	6.19	......	3.56
Back Cracked	2.06	6.52	1.18	0.47	2.08	......	0.74	0.42	0.60	1.42	1.04	2 40	9.09	2.22	1.90	4.21	2.03	13.22	0.33	1.08	1.91	1.40	0 28	1.59	1.70	......	3.09	......	1.53
Back Chipped	0.31	......	......	0.09	0.52	......	......	......	0.67	......	......	0.62	1.82	0 74	......	0.19	......	0.90	......	0.20	0.44	0.43	......	0.40	......	......	......	......	0.11
Back Out	1.48	0.73	......	1.22	0.35	......	0.86	0 84	0.40	2.13	3.28	0.85	3.63	1.46	2.14	0.96	......	2.25	1.00	2.20	1.57	2.16	1.41	1.98	......	......	......	1.28	1.37
Upper Lug Off	5.53	10.87	9.41	4.21	3.30	..	1.54	1.68	1 60	14.18	3 28	1.33	1.82	1.48	6.64	2.63	4.06	9.53	7.97	7.08	5.89	9.17	7.63	5.95	6.77	8.11	3 09	5.13	6.58
Upper Lug Cracked	0.19	1.45	1.18	......	......	......	0.06	......	0.07	0.71	......	0.62	......	......	......	0.19	......	0.18	......	0.16	0.44	0.11	......	0.40	......	......	......	......	0.17
Lower Lug Off	1.25	3.62	......	0.94	1.04	......	0.49	2.10	1.00	1.42	4.92	0.62	3.63	......	0.95	1.72	1.35	3.06	1.33	1.07	0.59	1.40	1.13	1.59	1.70	2.70	......	5.13	2.30
Lower Lug Cracked	0.01	......	......	......	......	......	......	......	0.07	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Both Lugs Off	1.04	1.45	1.18	1.96	0.87	......	0.19	......	0.40	4.25	......	0.89	......	......	1 43	0.90	0.68	0.81	4.82	1.35	0.88	1.40	0.85	......	......	......	......	1.28	0.82
Head Off at Neck	2.18	......	1.18	5.61	1.22	......	0.12	2.52	3.14	3.55	1.64	1.78	1.82	2.22	0.95	2.80	1.35	0.54	1.66	3.06	0.74	......	1.41	1.19	5.08	......	1.08	14.10	3.12
Barrel Off Shoulder	2.11	4.34	......	2.53	1.56	......	0 43	0.84	3.87	2.18	1.64	1 69	1.82	4.45	0.95	4 22	0.35	3.24	0.67	2.20	1.03	......	0.85	4.76	1.70	2.70	2.06	8.97	3.28
Draft Bolt Pl'd Thr.	1.96	1.45	......	0.09	1.74	3.57	......	......	2.27	0.71	......	0.89	5.46	3.70	0.24	1.72	0.68	19.60	......	0.62	0.93	2.48	2.26	0.79	......	2.70	6.19	......	0.71
Burnt	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Worn Out	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
No Defects Obsrv'd	0.02	0.73	......	0 19	......	......	......	......	......	......	......	......	......	......	......	......	......	0.09	......	......	......	......	......	0.40	......	......	......	......	......
Miscellaneous	0.79	0.73	3.52	0.56	1.89	......	0.19	0.61	1.40	0.71	......	0.91	1.82	......	1.48	1.15	2.03	1.44	1 66	0.55	0.83	0.22	......	1.98	......	5.41	......	6.41	0.55
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00	100.00	100.00	100.00	100.00	100 00	100.00	100.00

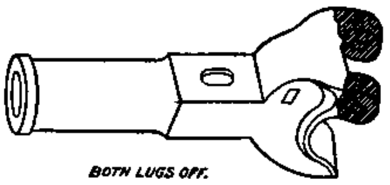

ARM OFF.

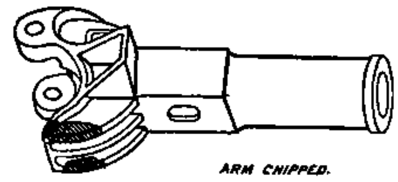

BACK CHIPPED.

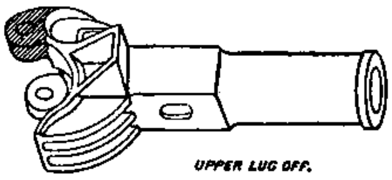

LOWER LUG CRACKED.

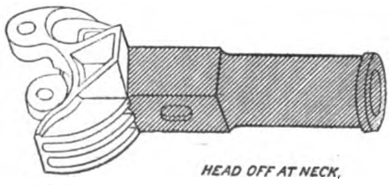

ARM CRACKED.

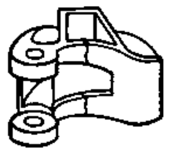

BACK OUT.

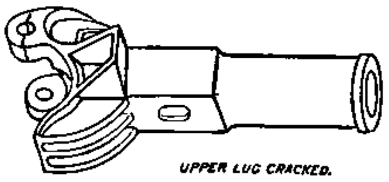

BOTH LUGS OFF.

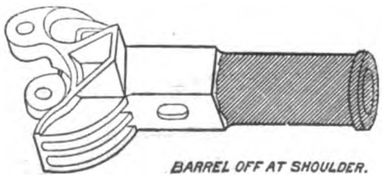

ARM CHIPPED.

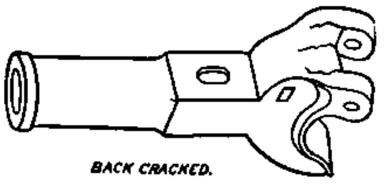

UPPER LUG OFF.

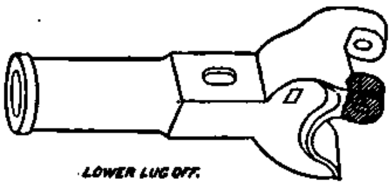

HEAD OFF AT NECK.

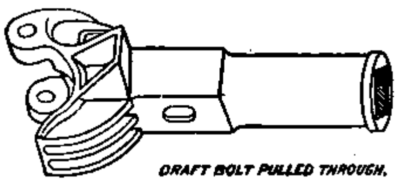

FACE CRACKED.


UPPER LUG CRACKED.


BARREL OFF AT SHOULDER.


BACK CRACKED.

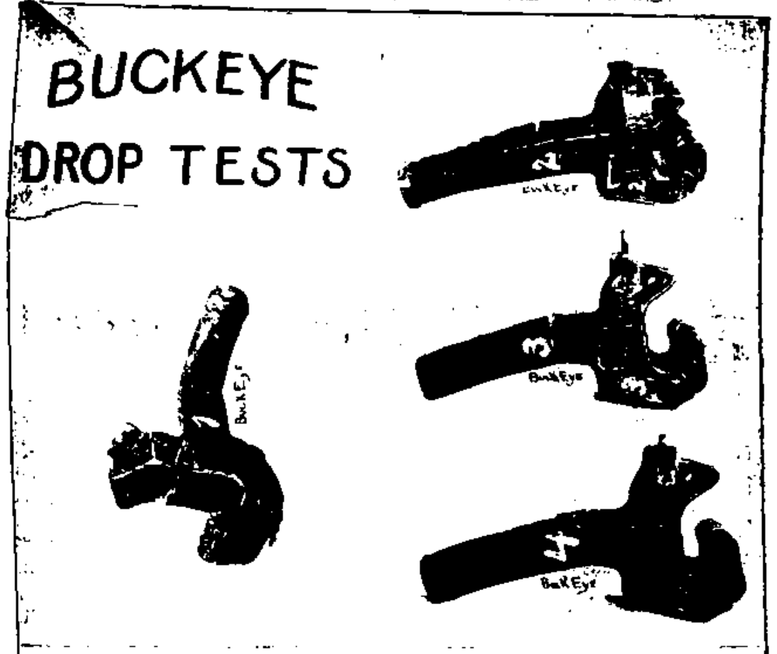

LOWER LUG OFF.

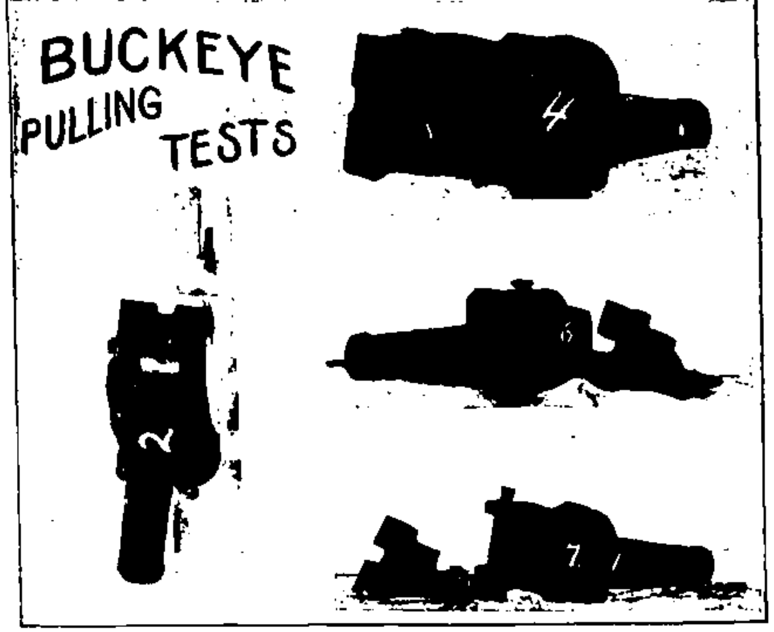

DRAFT BOLT PULLED THROUGH.

THE DEITZ M. C. B. DRAW-BAR.

The illustrations herewith show the construction of the Deitz M. C. B. draw-bar. In these illustrations, Fig. 1 is a horizontal section taken through the center of the bar, and Fig. 2 is a section at XX. Fig. 1 shows the details of the lock and operating lever. The lock is pivoted in the guard arm, and is moved up and down by the operating lever. The latter is in the form of a bar or slide, which passes through the bar directly beneath the lock. When the knuckle is closed the locking arm swings directly in front of the lock and holds it firmly in a closed position. When the knuckle is to be unlocked the operating bar is drawn out, and the projections thereon lift the lock into the position shown by the dotted lines in Fig. 2. By leaving the operating lever in this position the lock will remain up until the knuckle is closed, when it falls down. If the operating bar is placed in its normal position the lock drops down, as shown by the solid line, and when the knuckle is closed the locking arm slides beneath the lock, forcing it up as it passes. After the knuckle is closed, the lock, of its own weight, again drops down, completing the locking. If the bar is pushed in as far as it will go, the lock is lifted up and remains in that position until the bar is again pulled out. A small dog is provided for the purpose of automatically throwing the knuckle open. This dog is operated by a projection on the lower side of the operating lever, which is shown in Fig. 2. The first movement of the locking bar unlocks the knuckle, and a further movement brings the dog into action and forces the knuckle open.

A separate unlocking device is provided in the



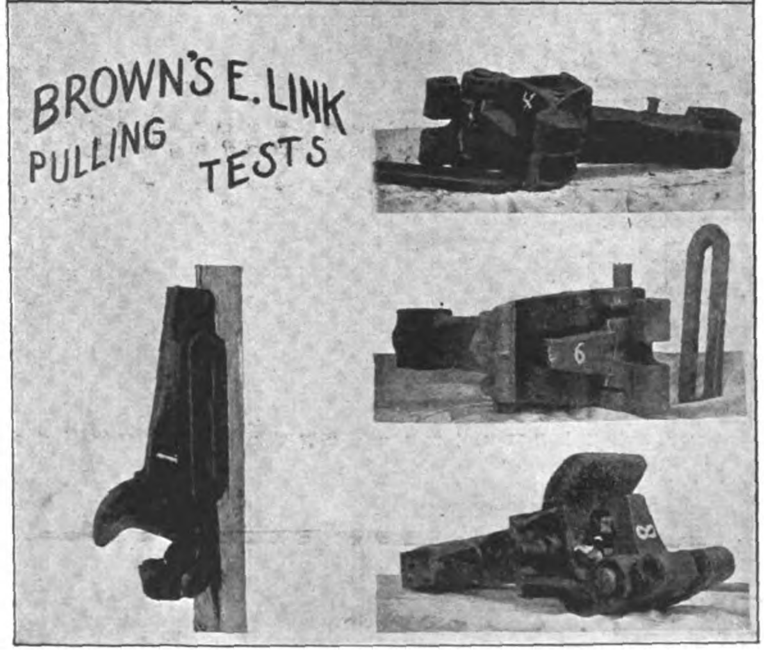


COUPLER BODY, MALL. IRON. KNUCKLE, O. H. STEEL. STEEL PIVOT PIN, 1½ INCH. Total number of parts, 8. Manufactured by the Buckeye Automatic Car Coupler Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	222	231½	220	226½
Weight of knuckle	57½	55¾	66½	55½
Does it pass M. C. B. limit gage?	Yes.	Yes.	Yes.	Yes.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	7	1	2	5
Total blows required to break	10	4	5	8

Pulling Tests.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	220½	227¼	222¾	228½	228¼	222¾	224¼	221¾
Weight of knuckle	58	57¾	58½	59	58⅝	57½	58	57¾
Does it pass M. C. B. limit gage	Yes.	Yes.	No.	Yes.	No.	No.	Yes.	Yes
Pull required to break	.....	163,180	.....	139,000	.....	147,000	169,100	.....

Knuckle broke in Nos. 2, 4, 6 and 7. Knuckle opened all right in all other cases.
Pivot pin slightly bent in all cases except No. 4.
Single Lug Test.—Broke lower lug of No. 3 at 133,700 pounds.
Draw-Bar Test.—Broke upper draw-bar lug at 125,800 pounds.

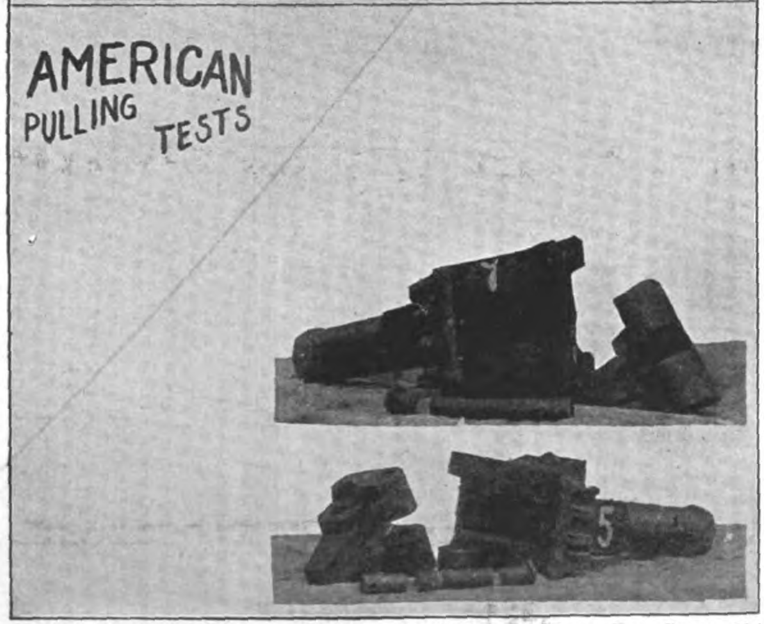


COUPLER BODY, O. H. STEEL. PIVOT PIN, STEEL, 1½ INCH. Total number of parts, 13. Manufactured by the Solid Steel Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	233¼	234	231¼	229
Weight of knuckle	38	36½	38	36
Does it pass M. C. B. limit gage?	No.	No.	No.	No.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	3	3	4	1
Total blows required to break	6	6	7	4

Pulling Tests.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	231¼	231¾	230½	227½	224½	226¾	231	232½
Weight of knuckle	37⅛	36¼	36½	36½	37½	36¼	37	36¾
Does it pass M. C. B. limit gage?	No.	No.	No.	No.	No.	No.	No.	No.
Pull required to break	147,720	.....	.....	133,900	.....	149,200	.....	145,300

Knuckle was broken in Nos. 4 and 6, and it would not open after test in any case.
Pivot pin bent or partly sheared in every case.
Single Lug Test.—Lower lug of No. 5 broke at 99,500 pounds.
Draw-Bar Test.—Broke lower lug of draw-bar through pivot pin hole at 139,900 pounds.



COUPLER BODY, O. H. STEEL. KNUCKLE, O. H. STEEL. PIVOT PIN, STEEL, 1½ INCH. Total number of parts, 10. Manufactured by the Solid Steel Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	228½	220¼	223	228
Weight of knuckle	52¼	52¼	52¼	52
Does it pass M. C. B. limit gage?	Yes.	No.	No.	No.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	12	7	12	7
Total blows required to break	15	10	15	10

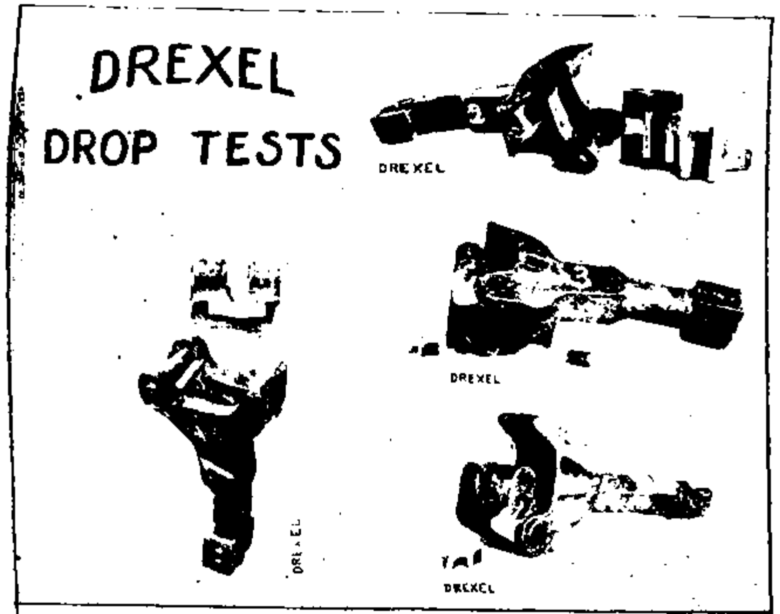
Pulling Tests.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	215¾	226½	227⅛	224¾	227	225½	227¾	225½
Weight of knuckle	52	52½	52	51¾	52½	51¾	52½	53
Does it pass M. C. B. limit gage?	Yes.	No.	No.	No.	Yes.	No.	No.	Yes.
Pull required to break	.....	146,300	157,400	.....	156,800	.....	158,300	.....

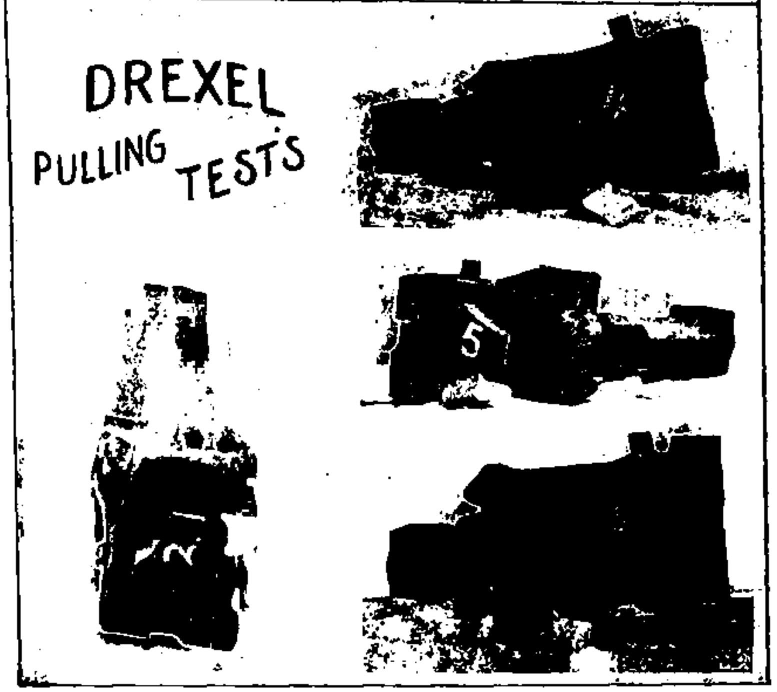
Knuckle pulled out in Nos. 3, 5 and 7, and knuckle would not open after test in Nos. 2 and 8.

Pivot pin sheared off in Nos. 3, 5 and 7, and was partly sheared or bent in all other cases.

Single Lug Test.—Pivot pin bent and knuckles slipped past without fracture at 135,000 pounds.

Draw-Bar Test.—Broke upper lug of draw-bar and started a crack behind the head at 219,900 pounds.





COUPLER BODY, O. H. STEEL. KNUCKLE, O. H. STEEL. PIVOT PIN, STEEL, 1¼ INCH. Total number of parts, 7. Manufactured by the Solid Steel Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	207½	206	208	206½
Weight of knuckle	58	58	57	58
Does it pass M. C. B. limit gage?	Yes.	No.	Yes.	No.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	7	4	7	3
Total blows required to break	10	7	10	6

Pulling Tests.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	199	201	207¾	198⅛	201½	202	200½	200¾
Weight of knuckle	58½	56¼	58¾	57¾	56½	59¼	57¼	57¾
Does it pass M. C. B. limit gage?	No.	No.	No.	No.	Yes.	Yes.	Yes.	No.
Pull required to break	......	161,600	......	147,900	146,000	......	......	163,700

Knuckle was broken after tests in Nos. 2, 5 and 8, and knuckle would not open in Nos. 3, 4 and 6.

Pivot pin was bent in every case.

Single Lug Test.—Broke upper lug of No. 3 at load of 120,500 pounds.

Draw-Bar Test.—Broke special steel attachment and sheared pin, draw-bar lugs bent outward to an angle of 25 deg., but not broken at 214,100 pounds.

COUPLER BODY, O. H. STEEL. KNUCKLE, O. H. STEEL. PIVOT PIN, STEEL, 1¼ INCH. Total number of parts, 7. Manufactured by Chicago Tire & Spring Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	221½	221½	220	223
Weight of knuckle	53	53	53½	53½
Does it pass M. C. B. limit gage?	No.	No.	Yes.	Yes.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	18	17	9	12
Total blows required to break	21	20	12	15

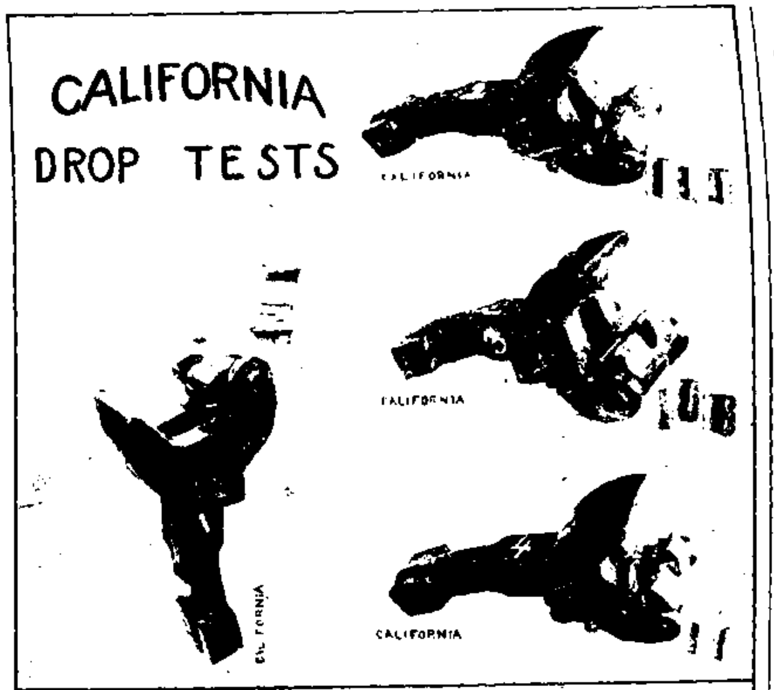
Pulling Tests.	No. 1.	No. 2.	No. 2.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	222	216	220	217¾	219¾	222¼	218	217¾
Weight of knuckle	53¾	54¼	53¾	53½	53¼	53¾	53¼	51¾
Does it pass M. C. B. limit gage?	Not t'st'd							
Pull required to break	195,200	......	......	169,700	185,600	......	171,100	......

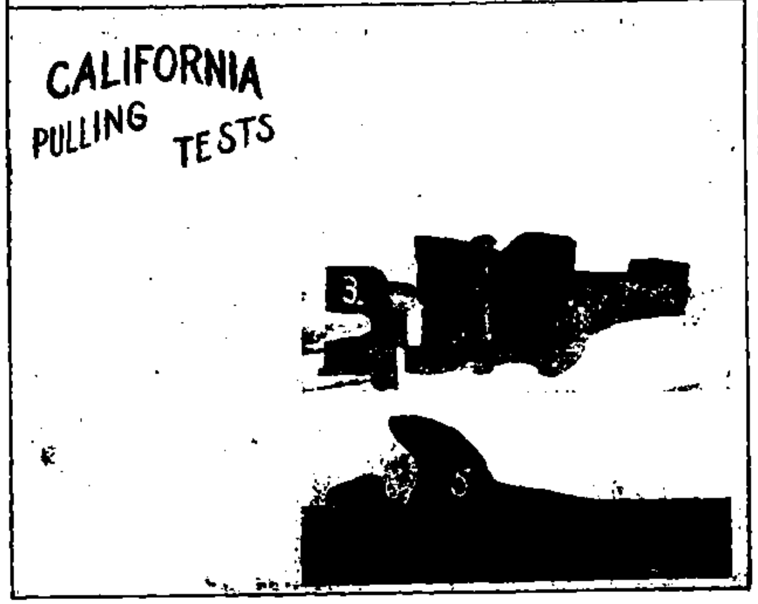
Knuckle broke in Nos. 4 and 7. Knuckle would not open after tests in Nos. 1, 2, 3, 6 and 8.

Pivot pin broke in No. 5, and was bent in all other cases.

Single Lug Test.—End of locking arm of No. 2 sheared off at 154,600 pounds.

Draw-Bar Test.—Broke upper draw-bar lug through pivot pin hole at 209,500 pounds.





COUPLER BODY, O H. STEEL. KNUCKLE, O. H. STEEL PIVOT PIN, STEEL, 1½ INCH. Total number of parts, 7. Manufactured by the Solid Steel Co.

Drop Tests.	No. 1.	No. 2.	No. 3.	No. 4.
Weight of coupler complete	227	216½	221	226½
Weight of knuckle	33	34	34½	34
Does it pass M. C. B. limit gage?	No.	No.	No.	No.
Blows at 10 ft.	3	3	3	3
Blows at 15 ft.	10	8	10	10
Total blows required to break	13	11	13	13

Pulling Tests.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Weight of coupler complete	222	224½	223½	221½	215½	226½	220	235½
Weight of knuckle	34¾	35¾	35¼	35	35¾	35¾	35½	35½
Does it pass M. C. B. limit gage	No.	No.	No.	No.	No.	No.	No.	No.
Pull required to break	......	126,800	117,100	......	..	119,900	......	130,100

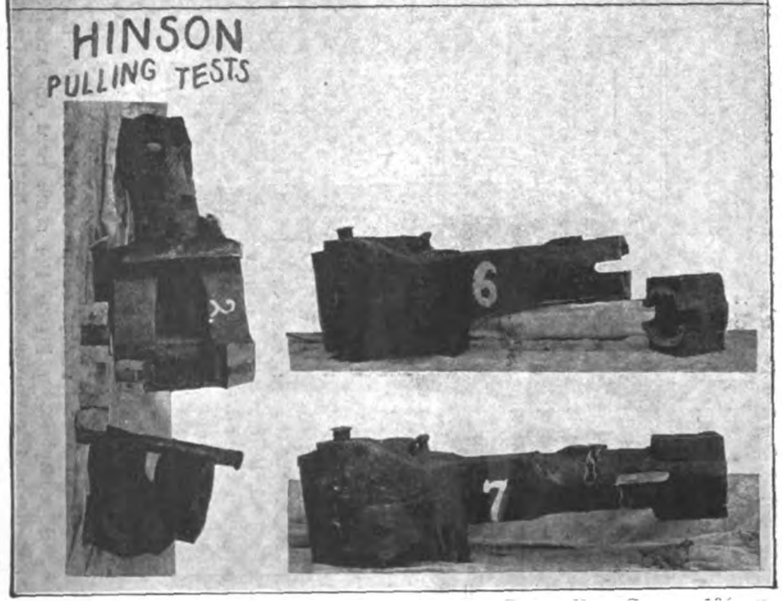
Knuckle was broken after test in No. 3, and knuckle would not open in any case.

Pivot pin was broken in all cases.

Single Lug Test.—Couplers separated at 70,000 pounds by bending the knuckle tongue backward.

Draw-Bar Test.—Broke lower draw-bar lug through pivot pin hole at 139,900 pounds.


HINSON
DROP TESTS
2
HINSON
3
HINSON
1
HINSON
4
HINSON


HINSON
PULLING TESTS
2
6
7